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1200 Pennsylvania Ave. NW.
Washington, DC 20460

From : George Peridas, Ph.D.
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Re: **Comments of the Natural Resources Defense Council Science Center on EPA's Revised Draft Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska**

On behalf of the Natural Resources Defense Council (NRDC) and our 1.4 million members and activists, we are writing to provide comments on the April 2013 revised draft assessment entitled "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska" ("2013 Assessment"). These comments were developed by NRDC's Science Center, an organizational unit staffed by scientists to provide expertise, analytical resources and support for the application of sound science to development, improvement and evaluation of environmental and public health policies.

For our review and comments on the 2013 Assessment, we have drawn upon our expertise in aquatic ecology, fisheries biology, climate science and engineering. Our objective with these comments is not to offer detailed technical review of the many analytical elements of the ecological assessment, the peer review comments or public comments, but rather to provide a holistic review of the Environmental Protection Agency's (EPA) process for developing the 2013 Assessment and of the assessment's results relative to EPA's authority under the Clean Water Act to prohibit, deny, or restrict discharge of dredged or fill material from mining activities in the Bristol Bay watershed.

Based on our review, we find that:

- EPA's process for developing the 2013 Assessment was rigorous, transparent and responsive to peer review and public comment.

- The 2013 Assessment is well laid out, comprehensive, based on the best available science and information, and clearly written.
- The 2013 Assessment correctly identifies the Bristol Bay watershed and its fisheries as irreplaceable resources of global importance.
- The 2013 Assessment identifies serious negative impacts to fisheries and ecosystems that will result from large-scale mining in the Bristol Bay watershed.
- The 2013 Assessment is "conservative" in its impact assessments, meaning that it underestimates the potential impacts from mining.
- The 2013 Assessment shows that mitigation and remediation cannot protect or compensate for the negative impacts.
- Results of the 2013 Assessment strongly support prohibition of mine development in the Bristol Bay watershed.

More information on these conclusions is provided below.

A. The 2013 Assessment has been Developed in a Diligent and Transparent Manner and is Scientifically Sound and Rigorous

The Bristol Bay watershed assessment was developed by a team of scientists with expertise in appropriate disciplines, including fisheries biology, mining, geochemistry, and anthropology, who reviewed, analyzed and synthesized a wide range of existing information, including peer-reviewed scientific journal articles, agency reports and information provided by staff, tribal elders and other experts from around the world.

The initial draft of the assessment was both made available for public comment and submitted to an independent peer review panel comprised of scientists and experts not involved in development of the assessment. The peer review panel, selected by an independent contractor following EPA and Office of Management and Budget guidelines, consisted of recognized experts from the appropriate disciplines. One meeting of the peer review panel was open to the public and the final peer review report was made available to the public. In all, more than 2000 people participated in the eight public meetings and two webinars, and EPA received ~233,000 written comments.

The 2013 Assessment is the product of all of this earlier work. Based on our review of the 2013 Assessment, the 2012 peer review comments and a range of public comments, we find that the 2013 Assessment provides a rigorous and thorough assessment of the effects of large-scale mine development, operations and post-mining management on the Bristol Bay watershed and its fisheries, aquatic ecosystems, and other associated biological and cultural resources.

Compared to the first review draft of the watershed assessment, the 2013 Assessment has been substantially modified and improved. EPA has done a commendable job of addressing the range of questions raised during the public comment and peer review process. In particular, the Agency: (1) expanded the range of hypothetical mine site sizes, (2), strengthened its analysis of the complex and interconnected hydrology of the region, (3) incorporated the risks and unknowns attendant to projected climate change, (4) added

"day-to-day" operational risks, (5) enhanced its analysis of cumulative impacts, and (6) added a review of potential mitigation measures. The result is a well-documented scientific analysis of the myriad unacceptable adverse effects that would result from mining, and which dictate in favor of protection under Section 404(c) of the Clean Water Act.

The scope, purpose, and structure of the document have been made clearer. The 2013 Assessment describes and explains the nature and purpose of an Ecological Risk Assessment (ERA), and its organization is consistent with Ecological Risk Assessment guidance. It articulates clearly the purpose of the ERA as a tool to inform environmental decision making, citing routine use of the ERA process to evaluate potential impacts when considering management decisions. It states up front that risk assessors, among others, determine the topical, spatial, and temporal scope needed, within which the ERA considers the potential effects of an activity. It also details the applications in which the assessment will be useful to risk managers such as scientists, resource managers, regulatory agencies, and other interested stakeholders.

The limitations of the assessment are discussed and the sources and methods used are clearly presented. The 2013 Assessment details the high level of interest concerning the impacts of potential large-scale mine development on the watershed's ecological resources, and is clear about the role of the assessment as a resource for interested stakeholders, members of the public, scientists and resource managers evaluating future projects, and future environmental assessments conducted under the National Environmental Policy Act. It also makes clear that the ERA focuses on a limited set of sources, stressors, and endpoints based on decision-maker needs, rather than the full set of factors that could be associated with the development of large-scale mining. This revised assessment includes risk evaluations for a broader range of biological and cultural resources, including resident fish species, aquatic invertebrates, wildlife and Alaska native cultures.

A range of mining scenarios based on worldwide industry standards as well as specific preliminary plans for the mine development and operation in Bristol Bay watershed are now evaluated, as per the peer review panel's recommendations. In addition, the assessment includes consideration of impacts for mine-associated development and transportation corridors. The assessment includes discussion of risks and impacts during mine development and operation, as well as those associated with the post-mining period. It also includes new discussion and evaluation of mitigation and remediation during the mine operation and post-mining periods.

The EPA is now seeking further public comment and a second round of peer review by the original independent 12-member peer review panel to ensure that the 2013 Assessment responds to their original comments. It is our understanding that EPA will consider the latest round of public comments and peer review before issuing the final assessment later this year. The solicitation of a second round of peer reviewer comments

represents a level of diligence and inclusiveness that goes beyond the usual as well as the Agency's own guidelines for peer review.[1]

B. Recent Comments by Northern Dynasty Minerals are Biased, Inaccurate and Misleading

On May 30th, 2013, Northern Dynasty Minerals (NDM), which with the Pebble Partnership holds mineral rights in the watershed, released its written public comments to the 2013 Assessment.[2] In those comments, NDM criticizes EPA's process for development of the assessment and peer review, claiming that it is biased, ignores agency guidelines for scientific peer review, and EPA has restricted public access to the peer review panel.[3] We find no evidence to support any of these claims: to the contrary, development of the assessment was conducted by a large group of scientists from diverse disciplines using all information made available to them with a transparent and well-designed independent peer review and public input process.

In contrast to NDM's claim that the analysis is biased against mine development, many of the peer review and public comments suggest that the impact analysis is too conservative. The peer review and public comment process has gone above and beyond what is required by agency guidelines: to address NDM's concerns would result in an endless cycle of comments, review and revision.

Moreover, NDM attempts to create the false and misleading impression that some of the sources used by EPA are not valid and were discredited during peer review.[4] In particular, the sources in question are studies by Kuipers et al., 2006; Earthworks, 2012; Wobus et al., 2012; Levit & Chambers, 2012; Chambers & Higman, 2012; Woody & O'Neal, 2010; and Woody & Higman, 2011. NDM does so by cherry-picking phrases from EPA's Supplemental Peer Review Reports[5] and presenting them out of context, which amounts to poor and inexcusable scientific practice. In fact, a majority of peer reviewers logged positive overall impressions and comments on the reports concerned. Any concerns they voiced were either specific to certain detailed aspects of the studies that are not central to the overall message or integrity of the studies' conclusions, or were

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[1] U.S. Environmental Protection Agency, "Peer Review Handbook, 3rd Edition", EPA/100/B-06/002, p.4. Available at: http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2012.pdf

[2] Available at: http://www.northerndynastyminerals.com/ndm/BristolBay.asp?Report_ID=586269&_Type=Bristol-Bay-Watershed-Assessment&_Title=Documents-Northern-Dynasty-2013-submission-on-revised-draft-Bristol-Bay-Wat...

[3] NDM claims that "EPA has ignored its own peer review guidelines and failed to provide for an open and transparent peer review process that keeps the public fully aware of the Panel's activities. EPA has restricted public access to the Panel, ignoring the need to ensure that Panel members consider a range of perspectives, data, and analysis from a wide variety of stakeholders." See: http://www.northerndynastyminerals.com/i/pdf/ndm/bbwa/NDM_Letter_ToEPA_May2013.pdf

[4] See Northern Dynasty Minerals, "Bristol Bay Watershed Assessment – supplemental Peer Review reports on studies submitted to EPA by Environmental Organizations and paid Anti-Pebble Activists". Available at: http://www.northerndynastyminerals.com/i/pdf/ndm/bbwa/Attachment_%20B.pdf

[5] Available at: http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=18206_5

within the bounds of normal scientific dissention without evidence of broadly shared concerns of fundamental scientific failings by all reviewers.

For example, the study by Kuipers et al., 2006,which NDM attempts to present as discredited, solicited the following general impressions from its four peer reviewers:[6]

David A. Atkins

"The report does an admirable job of identifying, evaluating, and synthesizing a lot of information (183 mines total, with 25 evaluated in detail). The sheer volume of information presented and the overly descriptive presentation style make the report difficult to digest. [...]
The report highlights the need for characterization and predictive methods to identify critical project impacts before the project is constructed, and the need for mitigation strategies to be developed with redundancy at multiple levels in an adaptive management approach."

Robert Kleinmann

"Kuipers et al. should be commended for the amount of data that they assembled and assessed. [...] Kuipers et al. took on a much greater task and apparently waded through many reams of environmental impact statements and their equivalents in search of data that could be used in this study and, in some cases, followed that up by contacting the appropriate regulatory agencies to obtain recent (at the time) water quality information. Some of the case studies that they cite are relatively weak in detail, but that is presumably due to limited information in the older files rather than superficial data extraction by the authors. Overall, I was impressed with the breadth of this study and surprised that I had not previously heard of it.[...]
The report is highly critical of the mining industry and the regulatory agencies that oversee it. Does it come across as biased? Perhaps slightly, in the nature of the information that it chooses to include and emphasize for each mine site (i.e., comparisons to drinking water standards are generally inappropriate for mine water discharges, except in the rare instance when the mining company is required to adhere to such standards); but in general, it attempts to report information without pointing fingers. After reading the report, it is clear that the hardrock mining companies, which were, after all, seeking permits to mine, were either optimistically or cynically emphasizing aspects that minimized likely adverse consequences. In addition, it is clear that the hardrock mining companies and perhaps the regulatory agencies overseeing them did not adequately emphasize environmental aspects during mine planning and mining operations."

[6] U.S. Environmental Protection Agency, Bristol Bay Assessment – Supplemental Peer Review Reports, Peer Review Comments on Reports By Kuipers et al. 2006 and Earthworks 2012. Available at: http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=513568

Dina L. Lopez

"I have reviewed the report entitled Comparison of Predicted and Actual Water Quality at Hardrock Mines by Kuipers et al. (2006) and found the report very interesting and well written. The authors present a thorough review of major metal mines in the U.S., with emphasis on mines that have presented EISs or Environmental Assessments (EAs) to comply with NEPA. [...]The conclusions are well supported, especially in terms of the identification of the factors that determine when the operation of the mine could impact surface and groundwater and why the predictions failed in the majority of the cases."

Christian Wolkersdorfer

"The report investigates in detail 25 case studies of the 183 major U.S. hardrock mines identified by Kuipers et al. and compares the predictive calculations of EISs with the real situation after mine closure.
Without having double-checked every single case, the data provided seem to be accurate and, without a doubt, the information – not the conclusions – they gathered is of great value for the mining business. To my knowledge, it is the first time such a comprehensive compilation of data was attempted, but several trials have been done before (Demchak et al. 2000 several sites; DeHay 2003 compared just one site; Werner et al. 2008 surface mine in Germany; and Brown 2010 for the U.S.).[...]
The conclusions they draw can only be used for the 25 case studies they investigated, as there is neither statistical proof that they represent all 183 major hardrock mines, nor can they be representative for future hardrock mines with more stringent environmental requirements than in the past."

These comments are, on balance, favorable and commend the work done by the study authors. As can be expected in scientific critique, they also raise some concerns about tone or the limitations of the methods and conclusions in the study, but the reviewers' comments do not in any way raise concerns about the overall validity of the study or EPA's subsequent citing thereof. We therefore commend EPA for having peer reviewed these reports and for making the reviewers' comments available to the public in a transparent way. We conclude that the overall scientific standing of these studies and EPA's use of them is intact and recommend that NDM's criticisms be disregarded.

Finally, it is not EPA's duty to make, nor the peer review panel's role to be available to external input, particularly from commercial entities with an obvious bias towards a particular outcome. The purpose of the peer review process and the task of the peer review panel are to ensure that credible, objective, subject matter experts critique the content of the assessment, document their findings in a transparent way, and result in meaningful improvements in the quality and rigor of the final product. We find that both the EPA and the peer reviewers have more than met those goals. It is neither required nor appropriate to subject the scientific experts to lobbying pressure by those with a clear commercial stake in the development of large-scale mining in the watershed.

C. Existing Conditions in the Bristol Bay Watershed

The 2013 Assessment identifies the Bristol Bay watershed as pristine habitat that supports diverse aquatic and terrestrial ecosystems, valuable commercial, recreational and subsistence fisheries, and cultural resources dependent on the watershed's productivity and beauty. The watershed, which is characterized by highly interconnected surface and groundwater resources, is virtually undeveloped—one of last remaining roadless areas in United States. In addition to one of the world's largest Chinook salmon fisheries, the Bristol Bay watershed is the stronghold of the world's largest wild sockeye salmon fishery: for the 1956-2005 period, the watershed produced 46% of the global abundance of wild sockeye salmon. A recent economic analysis valued the Bristol Bay fishery in 2010 at $1.5 billion.[7] As EPA correctly notes, the importance of the watershed for salmon "takes on even greater significance when one considers the status and condition of Pacific salmon populations throughout their native geographic distributions."[8] Pacific salmon have been eliminated from large percentages of their historic range in the western United States and, where they persist, their numbers and population viability are reduced. Evaluated on the basis of its salmon fisheries alone, the Bristol Bay watershed is a valuable and irreplaceable resource and sanctuary that the EPA correctly describes as a "significant resource of global conservation value."[9]

D. Demonstration of Substantial Negative Impacts

The 2013 Assessment evaluates the impacts for three mining scenarios that are based on worldwide industry standards and available preliminary plans for mine development and operation in the Bristol Bay watershed and which correspond to 0.25, 2.0, and 6.5 billion tons of ore extracted. The focus of the assessment is on impacts to salmon, which is appropriate given the strong scientific understanding of salmon biology and their environmental requirements. In addition, salmon are central to the well-being of the region's other wildlife, its people and economy, as well as to a subsistence culture that that dates back thousands of years.

The unavoidable environmental impacts that would result from "perfectly performed" mine development and operations with no accidents, leaks or failures identified and quantified in the 2013 Assessment include:

- Destruction of streams, wetland and floodplain habitats through excavation and filling associated with mine pits, waste rock piles, tailings impoundments, borrow pits and transportation corridors.

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[7] This report, which is available at: http://fishermenforbristolbay.org/wp-content/uploads/2013/02/CFB_B-ISER-FINAL-REPORT-5-10-2013.pdf , was published after the 2013 Assessment and should be reviewed and considered for the final Bristol Bay watershed assessment.

[8] U.S. Environmental Protection Agency, "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska; Volume 1 – Main Report", Second External Review Draft, EPA 910-R-12-004Ba, April 2013, §5.2.6.

[9] Id.

- Stream flow reductions resulting from stream blockage and surface and groundwater extraction. For salmon, stream flow conditions are important determinants of both the quantity and quality of their habitat.
- Water quality degradation resulting from discharge of mining and development related contaminants (e.g., dissolved copper, petroleum products, etc.) from leaching, direct discharges and catastrophic spills. The low buffering capacity of waters in this region, the highly connected nature of the surface and ground waters, and the large weather-related fluctuations in stream flows characteristic of Alaska's harsh climate all exacerbate the impact severity and difficulties to contain toxic contaminants discharged into the watershed.

The ecological and biological impacts resulting from these environmental insults include:

- Loss of habitat and impeded passage for fishes and other aquatic organisms. For the largest mine scenario, the assessment reports that 11% of total anadromous fish stream length would be lost.
- Alteration of groundwater–surface water hydrology, nutrient processing, and export rates of resources and materials for aquatic ecosystems downstream.
- Lethal and sub-lethal toxic exposure for fishes and other aquatic invertebrates.
- Direct mortality, reduced productivity and lower abundance for salmon (as well as associated reductions in other salmon population viability criteria, such as spatial structure and genetic and phenotypic diversity).
- Reduced biodiversity in aquatic and terrestrial ecosystems. Salmon are ecologically important "cornerstone" species[10] that affect ecosystem productivity and regional biodiversity through nutrient transportation.

The 2013 Assessment also reported that mine operations that did not meet current best practices and unplanned failures, such as failure of a tailings impoundment, would be expected to occur and would result in additional direct and indirect negative impacts on habitats, water quality and biota.

Based on our review, as well as discussion included in the 2013 Assessment itself, the impact analysis is conservative and underestimates the potential negative impacts of large-scale mining activities in the Bristol Bay watershed. For example, the largest mine scenario analyzed (Pebble 6.5) is based on mining operations that would recover only 60% of the estimated 10 billion metric tons of ore deposit. The 2013 Assessment assumes that mining and road systems will work as planned and that waste storage, treatment plant and transportation corridor spills can be quickly controlled even though the Alaskan environment is notoriously harsh and unstable. The 2013 Assessment also admits that total spawning escapement has never been documented for rivers in the mine claims and that many headwater tributaries have not been surveyed, rendering estimates of salmon abundance and range as minima and not realistic estimates on which to calculate potential

[10] Mary F. Willson et al., "Fishes and the Forest: Expanding Perspectives on Fish-Wildlife Interactions", 48 BioScience 455, 456 (1998), available at http://www.fish.washington.edu/people/naiman/contemporary/papers/willson.pdf.

impacts. The impacts from the entirety of the infrastructure and personnel needed to implement the project, which could be significant, are also not included.

In its comments, NDM argues that although the 2013 Assessment predicted harmful impacts from mine development, there was "no direct cause and effect linkage between mine development and impacts on Bristol Bay fisheries" and that "not a single negative impact on any fishery is demonstrated..." [11] Based on our review of the 2013 Assessment and our collective expertise in aquatic ecology and fisheries biology, this statement is not credible. It is not supported by the analytical methods or the results reported in the 2013 Assessment and, frankly, flies in the face of decades of scientific research and on-the-ground experience with the effects of mining activities on aquatic ecosystems, fisheries in general and salmon in particular.

E. Compensatory Mitigation is Not a Viable Option to Offset Losses

An important addition to the 2013 Assessment is Appendix J, which discusses various approaches for compensatory mitigation to restore, establish, enhance, and/or preserve wetlands, streams, or other aquatic resources for the purpose of offsetting authorized impacts to these resources by a permitted activity. This section also responds directly to several of the earlier public comments that suggested specific compensatory mitigation strategies, including beaver dam removal, stream flow management using water stored during higher flow events, and establishment of hatcheries to replace lost salmon production. As the appendix acknowledges, there are significant challenges regarding both the feasibility and efficacy of all of the potential compensation measures described. We already have decades of research and practical experience in the United States and elsewhere that document our inability to replace fish and ecosystem losses with either artificial propagation or engineered habitats. Therefore we agree with the 2013 Assessment's conclusion that there is a high level of uncertainty that sufficient compensation measures exist that could address impacts of the types and magnitudes of those that will result from large-scale mine development in the Bristol Bay watershed.

In its comments, NDM also asserts that impacts on fish habitats can be offset by opening up new habitat areas and creating improved habitat conditions, presumably by constructing fish habitat in otherwise pristine areas that currently support other ecosystems and biota but which do not contain fish. In our judgment, altering—and for at least some biological resources, negatively impacting—one habitat to replace loss of another is neither a sound nor effective approach for compensatory mitigation.

F. Prohibition of Large-Scale Mining Bristol in the Bay Watershed is Justified

The American Fisheries Society (AFS), a professional organization of fisheries scientists dedicated to advancing fisheries science and conserving fisheries resources, has

[11] The NDM comment letter is available at:
http://www.northerndynastyminerals.com/i/pdf/ndm/bbwa/Attachment %20A.pdf

examined the effects of mining on fish populations and habitat. In a 2012 article[12] that reported on a 2011 AFS symposium on *Fisheries and Hard Rock Mining* sponsored by Trout Unlimited, the Pebble Limited partnership, and the AFS Water Quality Section, they included the following recommendations:

- Designate sensitive lands and waters as off limits to hard rock exploration and development.
- Prohibit mines likely to result in perpetual water pollution and/or requiring perpetual water treatment.
- Prohibit mine discharges to surface or ground waters that degrade water quality.

The Bristol Bay watershed is a sensitive, globally significant and ecologically irreplaceable resource for fish, people and native cultures. Based on the results of the 2013 Assessment and its conservative estimates for unavoidable and persistent negative impacts to stream habitats and water quality, it meets each of the criteria identified by AFS for prohibition of mining activities. The near certain ineffectiveness of any form of compensatory mitigation reinforces this conclusion. Based on this, we believe that the EPA has sufficient information and justification to use its authority and issue a denial of use of the area because of unacceptable adverse effects on fishery areas under Section 404c of the Clean Water Act.

[12] The article that was published in AFS's journal *Fisheries* Vol. 37, No. 2 is available at: http://www.pebblescience.org/pdfs/O'Neal_Hughes_2012.pdf .